The Michigan Antique Radio Chronicle

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A QUARTERLY WRITTEN FORUM OF THE MICHIGAN ANTIQUE RADIO CLUB

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This Stewart Warner A72T4 gave Art considerable grief in this episode of The Shop.

THE MICHIGAN ANTIQUE RADIO CLUB

The Michigan Antique Radio Club was founded October 19, 1985 at the Dillon Inn in Lansing, Michigan. Present at this historical meeting to found MARC were Jim and Brenda Clark, Larry Anderson, Karl Rommel, Mike Male, Dick Perry and John Kent. The purpose of the organization is to preserve the history and enhance the knowledge of radio, television, and related disciplines, with special emphasis on contributions originating in the state of Michigan. Dues for membership in M.A.R.C. are $25.00 annually (US funds) and payable in January. Officers of M.A.R.C. welcome your membership, your questions and your personal contributions to enhance the service value, growth and activities of the organization. Terms of office for Board members expire concurrently with the summer EXTRAVAGANZA meet held in Kalamazoo, Michigan. Send Correspondence to MARC, 311 Wordsworth St., Ferndale, MI 48220. E-mail: president@michiganantiqueradio.org. **Visit our Web site at** www.michiganantiqueradio.org.

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The Michigan Antique Radio Club is willing to assist in the sale of estate collections of antique radios and other collectable electronic items. For information, please contact either Mark Oppat at 734-455-4169 or Jeff Lilly at 246-602-7513.

Perspectives

As you read this, we're less than a month away from the Vintage Electronics Expo Extravaganza '18 in Kalamazoo! I look forward to seeing all the old familiar faces there, and hopefully we will have a bunch of new ones to get to know as well.

We're also very close to launching the new MARC / VEE website, which should be up by the time you read this. Getting the new website up was a major challenge, but the expert and tireless work of Mark Waller has given us a page that is clearer and easier to use, is navigable on any device (computer, smartphone, or tablet) and has a lot of useful features that you've been asking for. You can now pay your membership dues, register for shows, and access all of our content in a much more streamlined fashion. We've added links to social media, so we can draw in more and more folks and let them know about our shows and what the club is up to. In the future, we'll be adding more features as well. We'd love to hear what you think and would love any suggestions you might have. Our address hasn't changed—you can reach the site at www.thevee.org or www.michiganantiqueradio.org, as always.

We're also in the process of designing and vetting a new MARC logo. Stay tuned for details, which should make their first appearance on the website.

At Extravaganza, we're once again offering an interesting slate of presentations. On Thursday night, John Reinicke will give a talk and demonstration on repairing record changers and turntables. When originally presented at the Winter VEE, it took the crowd by storm, so be sure to catch it here!

On Friday, back by popular demand, master woodworker Craig Cianciolo, who spent years working in Washington, D.C. conserving Congressional treasures, will brings all of his knowledge to bear on preserving and restoring radio cabinets. Don't miss it!

On Saturday, Antique Audio's Mark Oppat will be showing off the results of years of painstaking trial-and-error research into some interesting "back-door" fixes for console speakers, especially Zenith speakers. Others might have declared them scrap, but Mark shows you how to save them and make them work again.

Extravaganza will also feature all of the usual events that we look forward to: the live auction on Friday, two silent auctions and the donation auction on Saturday, our contest, and our all-indoor flea market in climate-controlled comfort with excellent on-site food service. Also, drop in on the President's Reception on Friday night at the Four Points. Check your flyers for times and further details.

Looking forward to seeing you all there!

Jeff

NOTES FROM THE SERVICE SHOP

No. 102

by John Reinicke

Art on Repair

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It was Saturday morning and I was enjoying a visit with Betty and Ken in their antique shop in Centerburg. Once again I had camped out in the vacant apartment above the shop and it had been my turn to pick up the bagels in the town square. As usual, we exchanged family gossip and photos. My last visit had been quite extraordinary, so I got around to asking.

"So, after finding that "Broadside" can I still talk to you guys now that you have joined the famous one percent?"

Ken smiled and laughed. "Gee, I don't know." (Dramatic pause) "Well, I suppose so!" We all got a chuckle and Ken continued. "After finding the Broadside I must say I might have gotten a bit overconfident."

I gave Ken a puzzled look. "Overconfident? Why do I think a story is coming?"

Betty chimed in. "OK, Ken, fess up."

Ken had a bit of a sheepish grin as he related the tale. "A couple of weeks ago, we went to an estate sale in western Pennsylvania. Those hills have a lot of old time farms and we had some high hopes to replenish our stock. The day of the auction it was cold and rainy so the auction was moved into the barn. The auction company made some effort to compensate for the circumstances but that barn was still cold and the lighting was just a string of construction lights.

"The flyer had mentioned antique furniture and household items so we were hopeful of a good find or two. As the auction went along we could see that the line between 'antique' and 'junk' had been, shall we say, blurred. Do you recall that period in the 60's when the English pub look was all the rage?" I grinned and nodded. "And that was followed by the Mediterranean look?" Again, I nodded. "Well, the family must have been enamored of both because we had never seen so many lots of furniture in that style. I must say, it was all in remarkably good shape but we just haven't seen much of a market for that stuff. Most of it was made of particleboard with veneer or, worse, wood grain vinyl. By lunch time the only thing Betty had found was a couple of lots of carnival glass and things were not looking good. After lunch, we decided to give it another hour to see if we could salvage the day since we still didn't have enough to cover the cost of a motel room and fuel for the van.

"Betty went off to check over the remaining lots and that is when I got in trouble. Out of the blue, a radio appeared on the stand. I know these things can bring a buck or two, so I started bidding. I had gotten intent on the bidding and did not see Betty across the room silently mouthing 'NO!' and shaking her head. By the time I noticed, the gavel came down before I could drop the paddle and I had won the bid for a grand."

Ken now had my interest. "So what kind of radio would inspire you to bid a grand?"

"Let me show you." Ken walked across the room and retrieved a small table radio under a cloth. "Before I show you, don't forget the lighting was bad."

Betty laughed, "Yea, yea, blame it on the lighting. I could spot that across the room."

Ken dramatically uncovered his find. It was an Emerson "Snow White" radio - the 1939 rectangular version, not the early cube version. It was perfect! The colors were vibrant and the famous characters stood out from the front in full relief. It was only after looking at it for a while that it sunk in. It was too perfect. Ken explained. "When I saw it I knew these things can bring a lot and we have customers that would be interested and I thought I could make out if I got it for under a couple of grand. Betty, of course, tried to stop me and after I picked it up I could see the characters on the front really did stand out and, in fact, there was even a bit of undercut behind them. Then I realized I had been 'had' – it was a reproduction.

"In our line of work, we know wood. As you know, the original Emerson set had a front panel of 'repwood'. And, as you also know, repwood is just cellulose fiber in a paste binder that is pressed into a mold and dried. It is only slightly better than papier-mâché made out of old newspaper. There is no way to get the crisp details that appear on that radio. With a close look, I could see it had to be resin made in a silicone rubber mold."

I took a look at the radio. The lines on the front were really crisp and clean. The paint was obviously new acrylic and even had a clear coat. The painted details were really quite well done in vibrant colors, right down to the squirrel on the shutter. "Wow, someone really went to a lot of trouble to do this. I would say it would qualify as a work of art in it's own right. It even has an Emerson chassis."

Ken noted the tone of my voice. "The way you said Emerson chassis makes me suspect you noticed something."

"Well, the chassis has 7 pin miniature tubes, and since the 50C5 didn't see production until 1948, I would have to say it is a post-war chassis with a really well done pre-war reproduction dial and pointer." I tried not to sound like I was rubbing it in. "If it makes you feel any better, I have seen reproduction Snow White radios before. I remember one at EXTRAVAGANZA several years ago and that one had been painted black. I suppose the idea was to make you think someone had painted it black and was intended to disguise the material. That one had been spotted before it came up for auction and the consigner decided to withdraw it. I also saw a painted one in a flea market. It was not this nice and had been 'aged' – clearly intended to deceive. I suppose the important thing to consider is that these things are 'in the wild'. We have no way of knowing how many may have been made so it really is caveat emptor. Try to look on the bright side. At least you got a really, really, well done, if fake, version."

Ken half smiled. "I decided to give the auction house the benefit of the doubt. A sharp auctioneer should have spotted it but it may have been a last minute entry. I doubt you could find out if the consigner was complicit or simply ignorant. And you are right - it really is well done. In fact, I liked it so much I decided not to raise a fuss and to keep it. I did point out to the auctioneer what I had noticed and he appeared to be both genuinely embarrassed and relieved that I decided to keep it."

Betty chimed in with a resigned laugh. "Yep, that radio and those two boxes of carnival glass really looked lonely in the back of the van. Sometimes it just doesn't work out. The only saving grace to that trip was that for dinner that night we found a bar with really good food and a really good, local, bluegrass band."

"So what are your plans for the radio?"

Ken responded. "Well, I like it so I will put it on display. I think folks will enjoy it and it will serve to remind me to pay attention."

We all agreed that furniture isn't the only collector 'sport' to have fakes and frauds. It was just about opening time and Fran, one of their employees, was just coming in the back door. Fran and Betty went into the front room to turn on the lights and unlock the front door as I waved, grabbed my coat, and headed out the back door. I had an appointment with Art. As I walked toward Art's house and shop, I could see they had flower boxes on the front porch that was above the flat roof of the shop – a sure sign of spring. As I walked up to the front windows I enjoyed Art's display of radios and record players for sale. I could see Art sitting at his bench in the back.

As I entered the front door, the bell caught Art's attention and he waved me over with a big grin. As I passed by the coffee pot, Art suggested that I grab my cup and join him at the bench. I hung up my coat, grabbed my cup, filled it, and walked over to the bench. "So what are you working on this morning?"

Art paused to take a good slug of his coffee. "This morning it is my signal tracer. I have been using this thing for decades and the last time I used it, I noticed the volume control had gotten scratchy so it was time for a little cleaning."

I leaned over to take a look. "That looks like an old phono amp with, let me guess, a 50C5, a 12AT7 and a 35W4."

"Right you are. It is, just that, an old phono amplifier out of a late forties Utah table record player. Every bench should have a signal tracer and this one has proven to be the 'bee's knees'. As you can see, it mounts in an old communications speaker box with a 5 by 7 speaker, which sounds good enough to make reasonable judgment about sound quality. To resolve any issues with a hot chassis, I have a one to one power isolation transformer also mounted in the box. It has a one meg-Ohm input impedance, which is great for old radios and it works well when checking phono cartridges and even microphones. Since it is tube type, if I happen to get careless around a plate circuit and inadvertently inject a couple of hundred Volts, no damage will be done. To further reduce the risk of high Voltage damage, I have a point one cap in series with the input. Of course, I replaced the capacitors a long time ago."

I nodded in agreement. "I also have a signal tracer made out of an old phono amp. So what were you working on when you got inspired about cleaning the volume control?"

Art went about reassembly as he replied. "Well, it came in quite handy on

a couple of radios just this past week. The first one was a solid state Grundig from the 70's. The complaint when it came in was, as the customer put it, it was too loud. It really wasn't 'too loud' but the audio was badly distorted. With a complaint and problem like this, I will connect the signal tracer across the high side of the volume control in the radio. In the case of this Grundig, the audio sounded just fine so I knew there wasn't a problem 'upstream' of the volume control. The RF, IF and detectors were just fine on AM and FM. I also noted that the sound quality actually was better, not good you understand, just better, when you turned up the volume.

"With the set connected to my bench speaker, the audio was really miserable at low volume and improved when the volume was turned up. These solid states sets often use a complementary PNP NPN output with the speaker connected to the emitters. To work properly, there has to be sufficient bias between the transistor bases to have them both forward biased. This time I found the same Voltage on both bases and the result is what is known as crossover distortion. The audio signal has to swing positive or negative far enough to forward bias the transistor. At low volume, this means you only hear the peaks, which sounds miserable. This set uses a heat sink mounted thermistor between the basses with a pot to set the appropriate forward bias. That pot was open and once there was proper bias, the audio sounded fine – at least on my bench speaker. Unfortunately, the speaker in the case had a rubbing voice coil, and, that too, will make for distortion that is often worse at low volume. I happened to have a new old stock TV speaker that fit and worked well."

I nodded in agreement and took a slurp of coffee. "You said a couple of radios."

"I did indeed and the second one was even more interesting." Art's face took on a bit of thoughtful look. "Over the past few years we have developed a small cadre of old radio enthusiasts here in Centerburg. I wouldn't exactly call it a radio club, but we do get together on an irregular basis. Some of the guys are fellow Amateurs and most are not. We have a couple of working technicians, a couple of retired engineers, a computer programmer and even three high school kids. I am really trying to promote interest in the field and not discourage anyone.

Before making ANY modifications, find the problem first.

"The radio in question is a late 30's Silvertone that Steve found at a garage sale. The case was in good shape so Steve set about a restoration. He did a really quite credible job of replacing capacitors and his solder work is fine. He had planned to bring it over so I could lead him through the alignment procedure and stopped over last Tuesday evening. As we were getting set up, he mentioned the sound was distorted and in the course of trying to find the source of the distortion noticed there was a 5 meg resistor from the AVC line to ground. He looked at the schematic and saw that it was noted as 5 M. Like a lot of us, he remembered that on old radio schematics they often used the Roman numeral designation and M would, of course, be thousand. He thought maybe it should have been 5 K ohm and gave

that a try. He noticed the sound was much better, but only on weak stations – strong stations would be distorted.

"We fired it up on my bench and confirmed what he had said. I connected the signal tracer to the high side of the volume control and noted the same distortion with the signal tracer. At this point I was fairly confident that the audio section of the set was OK. I asked Steve if he had checked the Voltage on the AVC line before he changed the resistor and he sheepishly said no. We decided to replace the resistor with a 5 meg resistor and with that done, the audio was badly distorted. At this point, we checked the AVC Voltage and discovered a positive 6 Volts. I pointed out that an AVC line should never go positive and should go progressively more negative with increasing signal. In fact, I will usually connect to the AVC line with a Voltmeter when I do alignment and use the reading to peak the IF coils. With the AVC line positive, the RF, and IF stages had grid bias that was positive and that biased those tubes into heavy conduction. The distortion was no longer a mystery. There shouldn't be a source of positive Voltage on the AVC line and we set out to find where it was coming from. The IF transformers have B plus for the plate of the mixer and IF amplifier tubes and a quick check with an Ohm meter confirmed a leakage between the primary and secondary of the second IF transformer. There was some source of leakage inside the IF transformer.

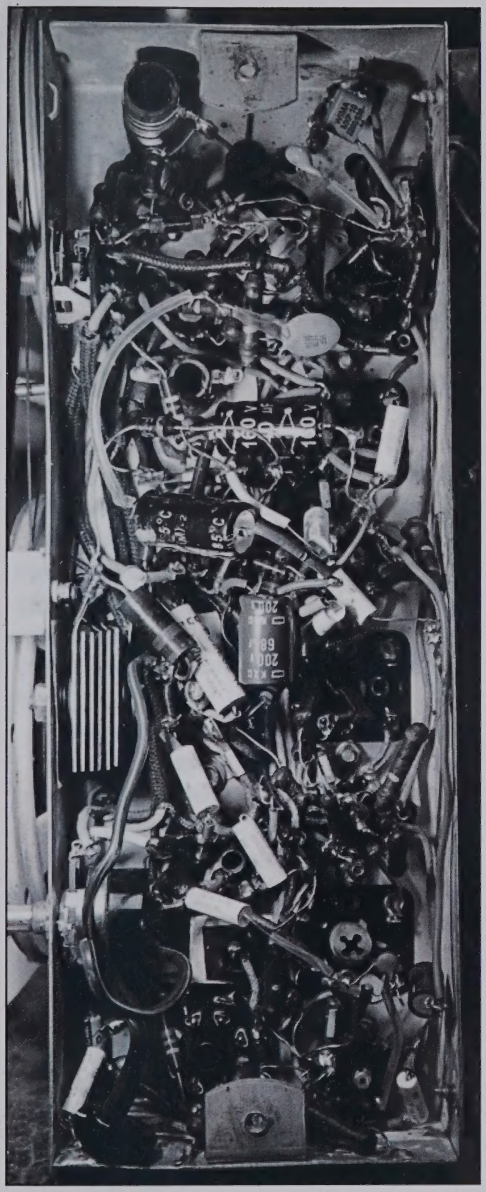
"We all have encountered this in the past and it often can be traced to the capacitors in the IF can. The plating material grows those little dendrites that connect and cause a short. Sometimes we get lucky and can take the cap apart and clean them up and sometimes we have to replace the capacitors. This was a bit of a surprise, though, because this set uses IF transformers with the trimmer caps at the top and these are usually quite reliable. These also require some care, since they are connected with wire pigtails rather than terminals. Anyway, when we got the guts out of the can, we could see a thin carbon trace between the two capacitors. We speculated as to the cause of the trace such as mouse urine, coal dust, or high humidity combined with plain ol' grime. We cleaned off the trace and coated the area with a little clear lacquer. With the repaired transformer back in the set, the distortion was gone and the alignment went smoothly.

"We both agreed, the take away from this is: Before making ANY modifications, find the problem first. With old radios, sometimes modifications are needed because parts are no longer available, but before you do that, find the root cause of the problem. Never make modifications blindly."

I nodded in agreement. "I am glad that worked out. Have you had any other adventures with fellow enthusiasts? "

Art grinned. "Oh yea! I have to show you this one!" He walked across the shop and retrieved a just post war chassis, a Stewart Warner A72T4. As he walked he explained. "This set was acquired by one of our young members, George. George is really enthusiastic and I sure don't want to damp his interest but, shall we say, he needs to work on his radio mechanic skills. In all fairness to George, this is probably one of the more complex 7 tube table sets you will encounter. He picked it up at a thrift store and decided to replace all the bad capacitors. When he was done he couldn't get it working and brought it in here for some help.

"Now when I worked for Clem, when



"Rat's nest" underside of the Stewart Warner A72T4 chassis

he got something like this, he would mutter in a very quiet voice, 'Goddamnittohell' – all one word. Clem was not given to strong language and the rest of us were not supposed to hear it, but we did, and we knew he had a real corker. When George pulled this out of the case, it was that expression that came to mind." Art placed the chassis upside down on his bench so I could see what he was talking about.

I looked at it and simply laughed out loud. "Holy Cow, I see what you mean. That is really quite a rat's nest."

Art had a bit of a smug look on his face. "A rat's nest it is, but it is a working rat's nest!"

"I'm impressed! What did you have to do?"

"As it turns out, it was a real adventure in trouble shooting. When I first tried it, I found it to be completely dead except for a faint hum – no AM, no FM. In a situation like this, I start from back to front. I touched a probe to the grid of the audio output tube and could hear a click so I assumed that the speaker, output transformer and 50B5 were in working order. I touched the center of the volume control with a screwdriver expecting hum but not this time. I found George had connected the end of the coupling capacitor that was supposed to go to the plate of the 6AQ6 to a B plus lead. Thus what I was hearing out of the speaker was an amplified ripple. Once I connected the capacitor to the plate I could hear scratching sounds when I moved the AM – FM switch. This led me to use contact cleaner and DeOxid on the switch.

"With the switch cleaned, the AM came to life. It was kind of weak, but working. I then went to the FM side and, once again, heard a hum. At least this time, I could adjust the hum with the volume control. It did not take me long to find the 0.5 mFd cap that was supposed to connect the audio section of the AM-FM switch to the ratio detector was also connected to a B plus line. Once I connected the cap to the correct spot, I

discovered that I could inject 10.7 mHz at the mixer and hear it in the speaker. This led me to suspect a problem with the RF amp. I assumed the mixer to be OK since the AM was working. I checked the tube and found it to be OK but the tube socket could benefit from an application of De-Oxid.

"With the tube socket cleaned, the FM started to work very faintly. I could just hear a couple of strong stations. At this point I decided to see if alignment would help. The AM IF was fairly far off, but mostly came around and the AM performance improved. I then decided to work on the FM alignment and that was a whole other matter. The FM IF was way, way, off frequency and every adjustment took several turns. As I brought the FM IF into alignment, the set started to motorboat and it wasn't a polite put, put, put. It was a sharp click, click, click. Out of curiosity, I connected the scope and could see bursts of 10.7 mHz that corresponded to the clicks.

"Motor boating usually indicates a bad bypass capacitor and darned if checking that didn't lead me to yet another misconnected capacitor. If such things can be funny, this one was because the capacitor was connected to itself. With the capacitor connected from B plus to ground, the motor boating stopped and I could finish the alignment. Along the way, I found a whole bunch of bad solder joints and just general sloppy work. I will have to mention to George that, particularly with FM sets, lead dress really does matter. I will also have to point out, that when you change a capacitor, if at all possible, you should unsolder the leads and clean out the terminal points. I will admit, at times, you have to splice a lead because the terminal is too hard to reach. Seven pin tubes, with their small sockets, can be quite difficult. If you make a splice, you should make a loop and make a good mechanical connection. Quite often, old leads will have a layer of corrosion that may take some scraping or the application of some additional solder flux. It can be a good idea to tin the lead before making the connection.

"With the alignment complete, the set does work. I also corrected an interesting problem. This set uses a selenium rectifier that George had bypassed with a silicon diode. That was OK. Since the set doesn't have a 35W4, they use a 22 Ohm resistor in shunt with the pilot lamp and that is in series with everything. When I started working on the set, I noted the lamp bulb was burned out and I just tried a new 47 bulb. Since the set was playing when I put in the new bulb, it was fine. However, when I turned it on the next time, the bulb flashed really bright and burned out. I deduced the inrush current was simply too much. It should be noted, by the way, the silicon diode makes the inrush worse since it has a much lower forward Voltage drop. A quick check showed the 22-Ohm shunt resistor, a 2-Watt carbon unit, had shifted to a bit over 50 ohms. I replaced it with a 5-Watt wire wound and thereafter, the pilot lamp survived the inrush. It makes a scary bright flash, but survives.

"I do have one other comment on this set. George replaced the filter cap, which was bad. However, he left the old one on top of the chassis. This, of course, preserves the appearance of the top. In this case the replacement capacitors located under the chassis added quite a bit to the general clutter. I think I would have come up with some way to mount the replacements above the chassis and sacrifice appearance for less mess under the chassis.

"The take away from this set, I sup-

pose, is: replace capacitors one at a time so you can keep track of where they are connected. Lead dress and general neatness really does matter. Solder really does have to flow and wet the mating surfaces. Solder should be used to make an electrical connection, not a mechanical connection. And there is one other very important point. NEVER EVER mess with alignment points unless you are actually doing an alignment with a calibrated signal generator. George is not the first to do this. Some times folks just twiddle the adjustments in blind hope it will do something positive. Sometimes folks will twiddle the adjustment to stop motor boating or some other problem. In most old radios, the alignment is usually quite stable over time and they really won't be that far off. Before touching the alignment screws, FIX THE PROBLEM first."

Art paused and laughed. "Of course I remember back in the day, a customer brought in a television set and he mentioned that he thought the problem was all those loose screws in the cans. He had, in fact, tightened every screw in every can. That is one that Clem only too happily foisted off on me."

I laughed. "Let me guess, it resulted in one of those expletives after the customer left?"

Art smiled, "As Clem would say, quite so, quite so."

We both enjoyed that exchange. I took a sip of coffee and asked, "So, have you encountered any other corkers?"

Art held up a finger. "Well, I wouldn't call it a corker, but I did encounter what should be a cautionary tale for audiophiles."

I nodded. "Working on some tube type audio?"

Art shook his head. "Nope, a table radio. A Nordmende Boheme. This set came in with a blown fuse in the primary of the power transformer and that always gets my attention. Fuses don't just blow. My first thought was to check for a shorted diode in the rectifier stack or a shorted filter capacitor. Once I had confirmed that there wasn't a shorted diode or capacitor, I proceeded to look for the source of the blown fuse. With the fuse out of the holder, I connected an ammeter across the fuse holder and used my variac to slowly bring up the line voltage while keeping an eye on the ammeter.

"The set came to life and the ammeter was reading a reasonable 450 milliamps. As I was checking for general operation, I noted that the AM bands were working fine but the FM was dead. I left the radio playing on an AM station as I looked at the schematic. I heard a crackle sound and noticed that the volume had gone down and the current had gone up to almost 600 milliamps. Before I could check, another crackle and the volume went up and the current went down.

"I sat back and tried to think of something that would cause that to happen and decided to take a look around the audio output primarily because that is a large user of B plus power. I took a look at the Voltage on the grid of the audio output tube. Since this set uses cathode bias on the output, I expected the grid Voltage to be zero. What I discovered was the grid Voltage was a couple of Volts positive. At this point I figured I had the problem sorted out. I assumed the coupling capacitor between the plate of the first audio amp and the grid of the output tube had developed leakage and, thus, applying plate Voltage to the grid. I also figured the leakage to be intermittent, and thus causing the variation in current. This is a printed cir-

(Continued on page 14)

The Whelco A-11

By Edward Dupart

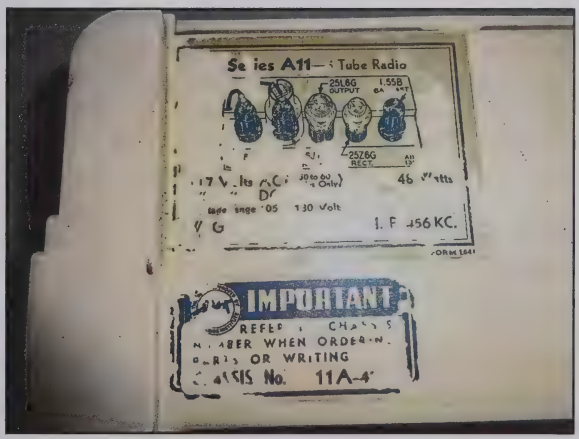
A friend of mine was having difficulty with this Whelco radio from 1939 and wanted me to look at it and I agreed. I never heard of a Whelco radio before so I did some research and I couldn't find any information, so I asked a friend of mine, Kerry, to see what he could dig up. He discovered Wells Gardner made it for the Whelan Drug store in Chicago, Illinois. I looked up a Wells Gardner A-11 and the schematic and the pictorial matched perfectly. Then I went to the Radio Attic Archives and looked up the Whelco and the Wells Gardner A-11 and both used the same cabinet. The Whelco radio used a different dial and had a Whelco decal on the lower front of the cabinet, otherwise the radios are identical except the one I have is ivory and the ones in Radio Attic Archives are brown. Mystery solved!

Now to see what's wrong with the radio. The owner had started replacing capacitors and since he is new at working on radios and soldering I had to do a little straightening up and so I remounted the filter capacitors. After that I felt comfortable enough to apply power to this set, which by the way is only a 4 tube set with a tube style ballast resistor, and so this set has no IF amplifier. I thought it strange to put such a cheap set into such a nice cabinet, but that's what they did. I fired it up and I could tell the audio stage was working, but all I got was a hiss at the lower end of the band with no stations coming in. I did the usual voltage checks and I found the primary of the one and only IF transformer to be open. Removing the IF transformer was easy and what I discovered was that one of the primary wires that went to the coil had broken off. I was able to unwind a little bit of the primary and solder back onto it, but it still measured open and that's when I knew the open was deep

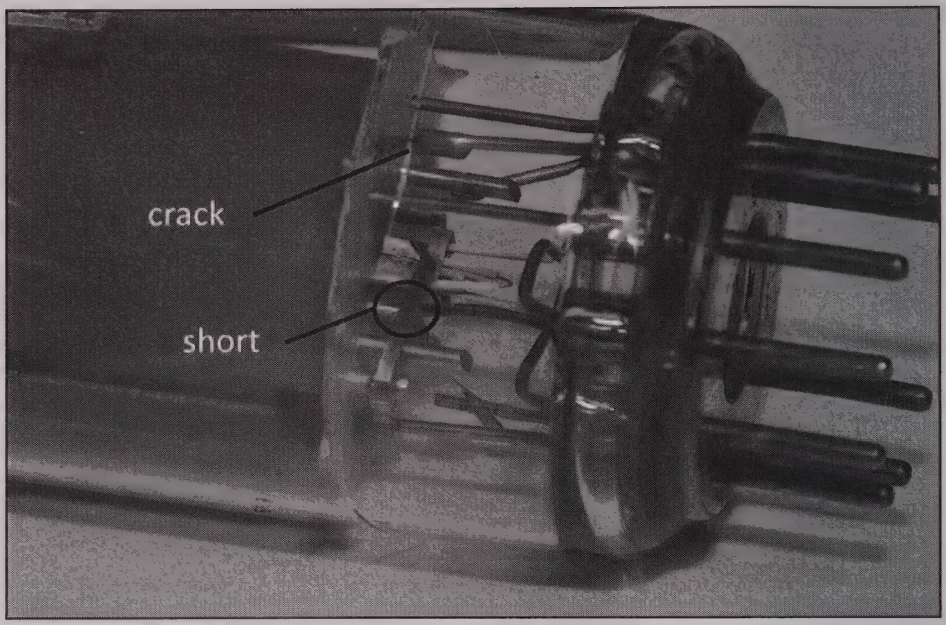
resistor and seeing if pushing more current through the tube would get it to oscillate and that worked. Finally, I'm picking up a station! I found if I used a 1500 ohm resistor the bottom end worked quite well, but the upper end would lose sensitivity, if I increased it to 10k the bottom end would cut out, but the top end worked great. Now my learning experience hits me and I decided to look at the resistance of the original IF transformer and compare that to the replacement and I discovered quite a difference. The original transformer has a primary resistance of 3.6 ohms and the secondary resistance is 5.2 ohms, far lower that the approximately 30 ohms for both primary and secondary windings of the replacement transformer. Checking another IF transformer yielded the same 20-30 ohm resistance. The original transformer would allow more current to pass through the mixer tube and so lowering the cathode resistor, and I settled on a 4.7k resistor, would allow more plate current to flow and would make up for the higher resistance of the replacement transformer. Also, readjusting the primary trimmer on the IF transformer affected the oscillator and that made it oscillate equally across the dial, which made sta-

down inside the coil. It looked like a standard IF transformer except the secondary trimmer's bottom end goes directly to ground rather than across the secondary and it wasn't inside the typical aluminum housing. I had a junk radio nearby and scavenged the first IF transformer out of it. I was about to encounter a new learning experience.

The IF transformer was easy to replace and after I replaced it I plugged it in. It still had the same hiss at the bottom end of the dial and no stations, which led me to believe the local oscillator was not functioning. Out came the RF generator and with that I found the IF to be working and was able to align the IF transformer which didn't take much. Injecting an RF signal in the oscillator circuit and tuning the RF generator 455KC above the incoming signal of a very strong local station, allowed that station to come through very nicely, which verified the oscillator was indeed not functioning. Measuring the resistance of the antenna and oscillator coil agreed with the schematic, so it looked liked the coils were OK. Next I checked the resistance of the cathode resistor in the mixer tube, 6J7, and the 12k measured 30k, so I replaced that and it still didn't work. Out came the resistance substitution box and I put that in parallel with the cathode



(Continued on page 20)



(The Shop, continued from page 11)

cuit set, so it only took a few minutes to use my solder sucker to extract and replace the suspect capacitor. I assumed this would correct the problem and was quite surprised to discover, it did not! When I checked, I still found a positive Voltage on the grid of the output tube. I also noticed that it was not steady. When the grid Voltage went up, the current would go up as you would expect since higher grid Voltage means more plate current. I also noted, when the grid Voltage went up, the cathode Voltage would go from the expected 8 Volts to more than 12 Volts.

"I studied the schematic to see if I could deduce the source of the extra bias and concluded the only possible source was the tube itself. I replaced the tube and all was normal. Clearly, there was some sort of intermittent short inside the tube that was, at times, causing it to draw excess current. At times, the excess current would actually be enough to blow the primary fuse. This piqued my curiosity and I took a close look at the tube.

"The first thing I noted was that the thermal stress from the excess current had caused some hairline cracks in the tube envelope. They had not caused failure – yet! I looked closely at the connections at the bottom of the tube between the bottom mica spacer and the pins. I noted there is a strap that runs from the cathode to the suppressor grid lead. The strap was supposed to bridge the control and screen grid leads but in this particular example, it was just barely touching the control grid – the source of the intermittent short and the source of the crackling sound I heard. This brings us to the caveat for audiophiles. The tube in question is a Telefunken EL84. These tubes are highly sought out by audiophiles and can bring on the order of two hundred bucks on line. Telefunken most certainly 'had their process under control', which means this is very likely

not the only one. I don't have any idea if this was limited to one person on the assembly line, or one batch, or when it might have been made. I don't know if the out of place strap was due to a bump in shipping. I do know that I have encountered other bad EL84s. I remember one that took out the power transformer in a Zenith stereo console and several that had broken right where I found the hairline cracks. Those I simply replaced and didn't think about it further at the time. For my present repairs, I use the modern J&J tubes, but if I were inclined to insist on new old stock Telefunken tubes, I would sure want to take a close look at those connections in the bottom of the tube."

I nodded in concurrence. "And, of course, one would want to have a return agreement for something bought on line. You mentioned something about the FM in that set. What was that?

"Well, the missing FM was rather more straightforward." Art was gesturing with some enthusiasm. For that, I used the signal generator and found the signal disappeared at the second FM IF as I worked my way forward. A check with an ohmmeter confirmed what appeared to be an open coil. We both know that FM IF transformers have rather large wire in the coils, so I figured an actual open coil was unlikely. As it turns out, this set makes use of printed circuit boards in the AM-FM IF transformer cans. The boards in those two transformer assemblies stick out of the bottom of the can and pass through a slot in the main circuit board. At assembly, when the board passed through the solder, the solder was supposed to bridge from the IF printed circuit fingers to the board traces. Now we both know that solder does not necessarily make a good mechanical connection and this was no exception. I found one of those solder bridges had a quite visible crack once you knew to look for it. A touch up of the solder connections resolved the problem and all was OK. When I checked the alignment, everything was really quite close and only took a tweak at most."

Art held up an index finger. "And one more thing. On these German sets, when you replace the fuse, one has to consider the difference between European and North American ratings. In Europe, a fuse rating is a 'must hold' rating and in the US, it is a must 'must blow' rating. So, for example, if you have a one Amp fuse that is carrying exactly one amp, in Europe it will continue to work indefinitely and in the US it will eventually blow. The difference is about 20%. In the case of this Nordmende, the fuse is rated 0.6 Amps and the US fuse would have to be 20% larger or about 0.75 Amps. I used a 0.8 Amp fuse for this repair since that is the value I could get. Of course, I used a 'slow blow' fuse so it wouldn't pop with the inrush surge."

I visited with Art as he reassembled his signal tracer and we took advantage of the time to exchange family gossip and tales. Art also asked if I had seen Ken's new Snow White radio and we both shook our heads at the story. We both agreed that it really was a striking piece of art even if it was a fake. Art also mentioned that Ken had him go over the chassis and Art found it had been quite nicely recapped and aligned so it worked quite well.

As the morning went along, we exchanged more 'war stories' about our repair encounters and I got to meet a couple of the Centerburg radio enthusiasts – a pleasant morning indeed.

The Proximity Fuse

Reprinted from *RADIO NEWS*, December 1945

Author Unknown

Editor's note: I came across this article while browsing some old copies of RADIO NEWS that were published just after the end of WWII. Secret technology was beginning to see the light of day, and the story of this radio-based proximity fuse, which probably saved a lot of British lives, is fascinating.

One of the most interesting applications of radio that has come out of wartime developments is the proximity fuse. Although the idea of such a fuse has been in the minds of men for many years, it remained for United States scientists to develop a practical working model through sheer perseverance in the face of seemingly insurmountable obstacles.

In ordinance terms, a fuse is that part of a projectile which detonates the explosive charge. An ideal fuse would detonate the shell at the most favorable position to inflict maximum damage on the target.

Early in the war it became evident that the speed, heights, and maneuverability attained by modern military aircraft presented a method of attack against which fuses currently available for anti-aircraft use were relatively ineffective. Despite the improvements in directing anti-aircraft guns by radar, it was increasingly apparent that the probably number of hits would rapidly diminish as planes improved. What was needed was a shell that would explode only when in proximity to its target and, because of the large numbers that would be required, it was necessary that they could be manufactured by mass-production techniques.

Although inventors had suggested almost every type of proximity fuse in the prewar and war years, none had indicated how the formidable engineering and development difficulties could be overcome. Preliminary tests indicated that the fuses would have to stand acceleration of the nature of 20,000 G's and a centrifugal force exerted by rotation up to 475 per second.

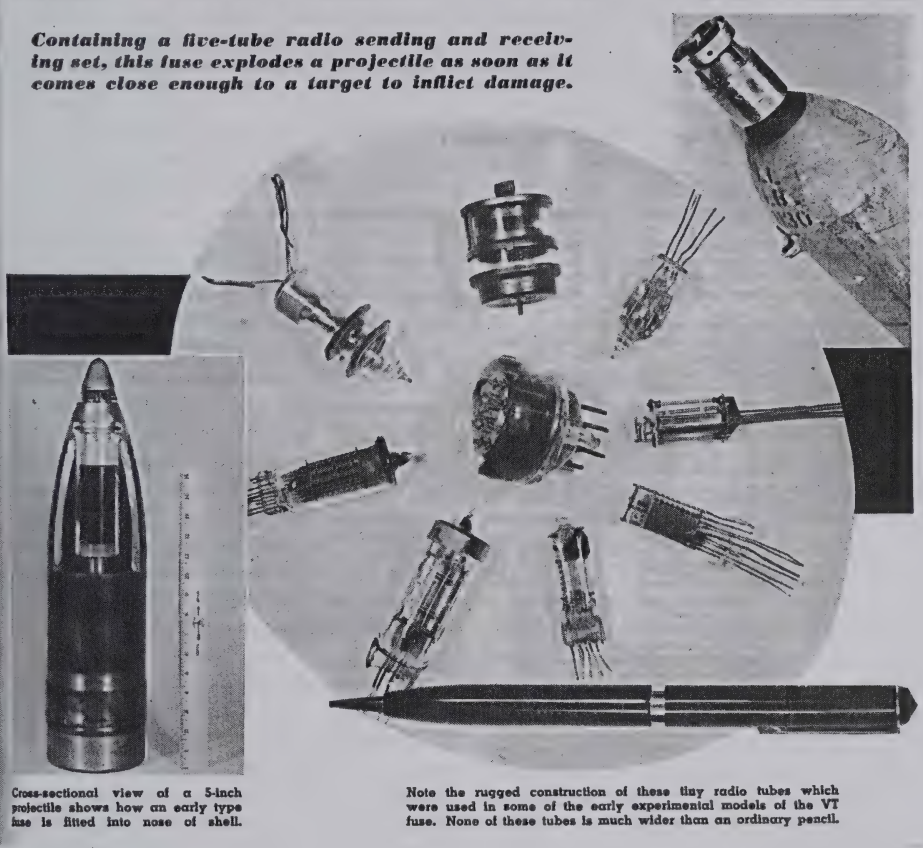
Among the types suggested as having practical possibilities were the photoelectric and acoustic types, along with the radio type. However, as a result of intensive research with all types, it was decided to concentrate on the radio type. Experimental models indicated that this fuse would fulfill the necessary requirements if the essential rugged components could be obtained or developed. It was readily apparent that one of the major stumbling blocks would be the procurement of sufficiently rugged tubes with the small dimensions required, along with the small percentage of failures necessary if the fuse were to be put in large-scale production.

Several of the leading tube companies undertook the development of tubes to meet these requirements. After many failures, a tube was developed which would take the tremendous abuse to be encountered. This tube appeared to have the possibility of being manufactured by mass-production techniques.

Basically, the proximity fuse finally adopted consists of a five-tube transmitter and receiver. Operation is as follows: The transmitter sends out a signal which is radiated by the small antenna in the nose of the fuse. The radiation pattern of this signal is essentially the same as the bursting pattern of the shell. As long as the shell is travelling through free space with no objects in the vicinity, the transmitter continues to operate with no corresponding receiver action. However, as a target is approached, the radiated signal is reflected by the target and changes the radiation resistance of the

THE PROXIMITY FUSE

Containing a five-tube radio sending and receiving set, this fuse explodes a projectile as soon as it comes close enough to a target to inflict damage.



Variable time fuse shown mounted to the nose of a 500-pound bomb.

Cross-sectional view of a 5-inch projectile shows how an early type fuse is fitted into nose of shell.

Note the rugged construction of these tiny radio tubes which were used in some of the early experimental models of the VT fuse. None of these tubes is much wider than an ordinary pencil.

antenna. As this resistance changes, a pulse is set up in the plate circuit of the oscillator, due to he varying load. This pulse is passed through an audio amplifier and, when it reaches sufficient intensity, is used to trigger a miniature thyratron tube. In the plate circuit of the thyratron, a squib consisting of a resistance wire encased in explosive is used. As the plate current of the thyratron starts suddenly when the grid reaches its operating potential, the resistance wire heats up, causing the explosive to ignite. This explosive, in turn, sets off a firing charge which is used to detonate the shell.

The distance at which the reflected signal is strong enough to set off the shell varies from 10 to 70 feet, depending on the size of the target. It can readily be seen that the reflected signal will, in all cases, be very weak, so that a large amount of audio amplification will be necessary. One of the greatest problems was that of sufficient audio gain with little or no microphonics. A high order of microphonics would have defeated the purpose, as these microphonics in themselves would have automatically set off the fuse.

Many problems in addition to satisfactory tubes beset the designers. Among these was the necessity for a source of power that did not deteriorate while the fuses were in storage. Ordinary dry batteries were satisfactory as far as the power went, but had the disadvantage that the life in storage

was only the shelf life, while under tropical conditions their life was so short as to make them impractical. After much experiment, a battery essentially the same as the dry type was developed, in which the electrolyte was contained in a small glass vial which shattered as the shell was fired from the gun. The electrolyte then ran into the battery, which was built in circular form, activated it and in this manner turning on the unit. Batteries made in this way have a very long shelf life, as there is no chemical action until they are activated.

One of the essentials of any fuse is that it protect the shell against premature explosion. If the fuse is likely to explode prematurely, there is much danger in handling it previous to its use. What is needed is some method to rendering the shell inactive until it is in motion. This was solved in the proximity fuse by means of a centrifugally operated switch which kept the squib shorted until the shell had been fired. The switch consisted of a small container of mercury, together with a porous diaphragm of powdered nickel. As the shell rotated after leaving the gun, the mercury was forced through this porous diaphragm by the centrifugal action, removing the short from the squib. This permitted the squib to be fired by the thyratron when the thyratron was triggered by the reflected signal.

At the beginning these fuses were developed for use by the Navy. However, the Army soon evidenced interest in this type of fuse.

One of the main factors in any new weapon is that of surprise. It was essential that the enemy be prevented from capturing any duds that might fall where they could be recovered. The Navy originally issued orders that none of these fuses could be used where duds might fall on land. However, it was apparent that if the fuse were to have wide application on land as well as sea fighting, some other method would have to be used. Accordingly, the fuses were fitted with detonating mechanisms that exploded on contact in the event the shell missed the target or failed for some other cause.

An additional safety feature was also incorporated in the fuse. This was a reed spin switch which is normally closed and only opened by centrifugal force. When the shell is at rest this switch shorts the thyratron condenser used to furnish the necessary firing current when the thyratron is triggered, opening the circuit when the shell rotates rapidly enough. As the shell rotation diminishes in flight, the reed gradually closes. By this time the mercury safety switch has unshorted the squib, and the condenser discharges through the squib when the thyratron is triggered. The purpose of this reed switch is twofold: it serves as a safety device prior to the firing of the gun, and it provides a means of self-destruction for projectiles that miss their target or fail to detonate, thus preventing their recovery by the enemy.

The effectiveness of the shells was first demonstrated in 1943, when 75 percent of the rounds fired by Naval 5" guns were time-fused projectiles, while 25 percent were proximity-fused. Of the airplanes shot down in this period, 49 percent were credited to time fuses and 51 percent to proximity fuses. These figures establish an advantage ratio of 3 to 1 for proximity fuses. Improvements in proximity fuses since that time have resulted in raising this ratio considerably. The relative size of a target as it appears to a proximity fuse is over 50 times that of a standard *contact* projectile.

Extensive tests and combat use of proximity-fused howitzer ammunition by the U.S. Army established the devastating effect of air bursts on light equipment, and especially on personnel not under adequate cover. This opened up consideration of proximity fuses for use in shore bombardments at all ranges, and the fuses were used for this purpose occasionally in the Pacific theater.

Air bursts of proximity-fused projectiles could be used against light topside equipment and exposed personnel on decks of enemy ships. The course of the war in the Pacific did not provide opportunity for this use of the fuse, however.

The proximity-fused projectile's margin of combat advantage over a contact fuse is even greater than over a time fuse. A comparison between the use of the contact-fused 40mm. antiaircraft projectile and the proximity-fused 5" projectile shows this clearly. Since for contact fuses the shell must actually strike the airplane to detonate, the lethal burst area of a 40 mm. projectile for an approaching airplane is quite small--about 60 feet square. The average lethal burst area of the proximity-fused 5" projectile is much larger for the same airplane—about 5000 square feet, since the shell will be detonated if it passed within a radius of 75 to 100 feet of the plane.

One of the most important uses of the proximity fuse was in the war against the buzz bombs that the Germans unleashed on Britain in June 1944. The following report from the official U.S. Army observer indicates clearly that proximity-fused antiaircraft projectiles were dramatically effective in shooting down the V-1 bombs:

"The first employment of VT fuses against the enemy came with the first launching of the V-1 flying bombs against London on 12 June 1944. The antiaircraft at first played a minor role in the defenses, being allowed to fire only when the weather was such that fighter planes could not operate. By the first of July it became evident that the defense system could be improved by allowing antiaircraft firing VT fuses to engage targets without interference from the fighter planes. Consequently, during the second week of July all antiaircraft weapons were moved to the Channel coast, where the fields of fire were mainly over ocean areas and where the bursts would not be dangerous to civilian personnel. From mid-July until mid-August, when the main V-1 attack ceased, some 500 heavy antiaircraft guns were free to engage all flying bombs approaching the coast. These weapons included five battalions of 90 mm. guns operated by U.S. Army personnel. The remainder were British 3.7" batteries. 90 mm. guns began employing VT fuses from the day they were moved into position. By the first week of August, practically all heavy weapons on the Channel coast were employing VBT fuses.

"The result of the advent of VT fuses was truly sensational increases in kills. For the last four weeks of the now famous 80 days of V-1 attacks, the record of antiaircraft was as follows: During the first week 24 percent of all targets engaged were destroyed; the second week, 46 percent destroyed; the third week, 67 percent destroyed; and the fourth week, 79 percent destroyed.

"The last day in which a large quantity of V-1's were launched against England, 104 were detected by early warning radar, but only four reached London. About 16 failed to reach the coast, having malfunctioned over France or the Channel . . . while antiaircraft accounted for 68."

A total of something over ten million of these fuses were produced during the years of 1943 to 1944. No figures are available for the year 1945, but it is probable that several million more were made in this period. When it is considered that each fuse contains five tubes along with the other component parts, the tremendous production job that was done in utmost secrecy can be seen. Few of the workers had any idea of the ultimate use of the tubes or other parts, and it was only through the greatest care that the job was carried to a successful completion without valuable information reaching the enemy.

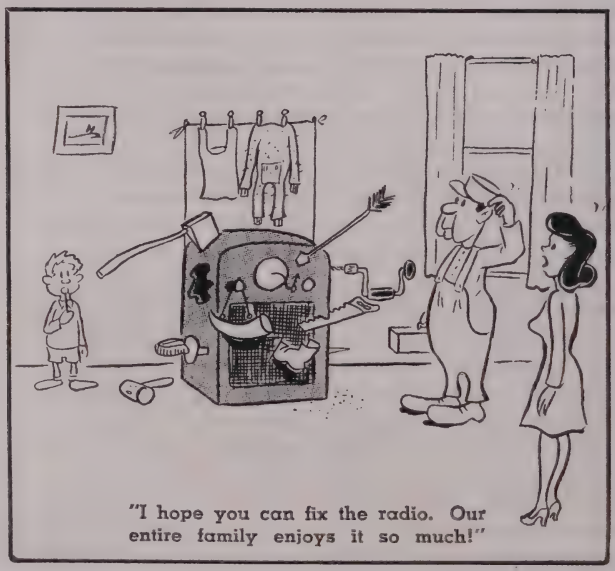
(Welco A-11, continued from page 13)

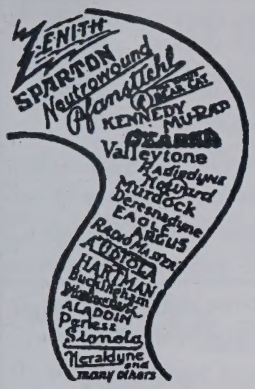
tions come in equally well across the dial. Finally, the radio works great.

A note on tube shields and other shields in general. Manufacturers put shields in place for a reason, usually to stop oscillation. In some early AC sets I have found the radio will oscillate so hard that the set appears to be dead without the shields. Put the shields in place and the radio works great. I was experimenting and I wanted to see how this Whelco radio worked without the tube shield. Without it, it was picking up an AC 60cps hum that was very annoying with the volume at low levels and was coming from the pilot light wires running near the 2nd detector 6J7. Those wires were injecting the 60cps into the 6J7. Both the glass 6J7's were replaced with metal ones and I would have thought the metal housing would have stopped it, but it didn't. I placed the tube shield over the metal 6J7 and the hum stopped completely. Amazing! Another problem arose when I hooked a long wire antenna to it and the strong local station was coming in loud and clear with the volume control all the way down. The long wire antenna lead in radiated into the antenna coil and the grid lead to the mixer tube. I wrapped a solid #26 insulated wire around the grid wire and grounded the new shielding wire and that helped immensely. Keep in mind, shielding is important.

To finish it up, I had to replace a couple more capacitors and several wires with crumbling rubber insulation. The dial pointer was crooked, so a little straightening took care of that. I went through and realigned all the trimmers and now with just my body as an antenna I picked up Canada, Nashville, Cincinnati and the list goes on. Not bad for a radio with no IF stage.

What I learned is to check the DC resistance of replacement IF transformers. Fortunately, with a little engineering I was able to make a common transformer work in this cheap radio with a nice cabinet.





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FINDER'S FEE: I am willing to pay a $100 finder's fee to the first person who can provide me the whereabouts of the Reuben Smith 5-tube TRF battery radio with a glass front panel (circa 1925) manufactured in Lansing, MI that I traded off to the late Oran Sauder of South Lyon, MI perhaps 25 or more years ago. Jim Clark, 517-648-2785 or jc072651@aol.com. Thank you.

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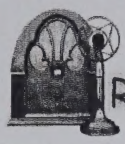

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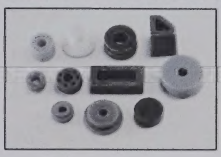

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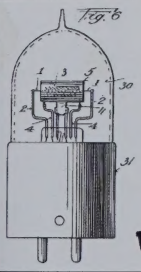

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Call for Articles

Your editor is always looking for new articles. Many of our readers have indicated a preference for articles related to collecting, as opposed to highly technical pieces. Of particular interest are personal accounts of a particular restoration you might have done, or historical accounts related to our hobby. But all subjects related to vintage electronics are welcome.

If you have an idea please feel free to discuss it with me, either by phone or email.

Steve Enzer, MARC Chronicle Editor, enzer@binsys.com. 517-592-2841

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Please send all submissions to:
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A Crazy Idea... Setting a World Record at the Kzoo VEE!

By Mark Oppat, MARC Media Relations

Ok, so it's a crazy idea but it just might work. With your help....

Maybe you heard, we had over 800 folks in the door at the Winter VEE. More than double what it was 4 years ago. Our online publicity coupled with new print and radio ads really has brought fresh interest in that show. "Newbies" and younger folks came. Sellers reported excellent sales and a vibrant energy flowed thru the show.

However, the "newbies" and "walk-in" traffic at Kzoo has not happened yet. The vendors and collectors love the new venue. The volume of seller tables is up each year. So, all good there. Just need to find a way to get locals to know about this great show now! How to do that?

Well I got to brainstorming. What's really hot now in vintage electronics? Records. Turntables. What's the hot way to reach folks? Online with YouTube, or social media like Facebook, Snapchat and such. Need something to "go viral". But WHAT?

Then it hit me... Set a **"Guinness World Record"!** But what could we do? Gotta be simple.... and in our world of vintage electronics.... hmmm.... aha ! How about we set a World Record for the most number of **Record Players Playing the Same Song Simultaneously!** Its a crazy, simple idea. Then, I thought, WHAT to play? Hmm.... gotta be an easy to find record. The **Beatles' "Hey Jude"** came to mind! Its slower, easy to synch-up and longer. Plus, its 50 years old this summer! And, there appears to be no such feat existing in Guinness Records... so we can set one easily!